

# **5 Theoretical Basis for SAM.aid — Guidance in Sediment Transport Function Selection**

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## **Purpose**

SAM.aid is a module of the SAM package that provides guidance in the selection of the most applicable sediment transport function(s) to use with a given river or stream. The traditional approach for selecting a function has involved collecting field data, including both suspended sediment measurements and bed material gradations; processing and testing that data with a number of sediment transport functions; and then selecting the function that best matched the field measurements. Because many of today's projects are on small ungauged streams and because field data are often too limited for this approach to be satisfactorily applied, SAM.aid was developed to provide an alternative in which only bed-material gradations and hydraulic parameters are required.

## **General**

Different functions may give widely differing results for a specified channel. Therefore it is important to test the predictive capability of a sediment transport function against measured data in the project stream or in a similar stream before its adoption for use in a sediment study. Also, different functions were developed from

different sets of field and laboratory data and are better suited to some applications than others.

Most sediment transport functions predict a rate of sediment transport for a given set of steady-state hydraulic and bed material conditions. Typically, hydraulic variables are laterally averaged. Some sediment transport functions were developed for calculation of bed-load only, and others were developed for calculation of total bed-material load. This distinction can be critical in sand-bed streams, where the suspended bed-material load may be orders of magnitude greater than the bed-load. Another important difference in sediment transport functions is the manner in which grain size is treated. Most sediment transport functions were developed as single-grain-size functions, usually using the median bed material size to represent the total bed. Single-grain-size functions are most appropriate in cases where equilibrium sediment transport can be assumed, i.e., when the project will not significantly change the existing hydraulic or sediment conditions. When the purpose of the sediment study is to evaluate the effect of a project on sediment transport characteristics, i.e., the project or a flood will introduce non-equilibrium conditions, then a multiple-grain-size sediment transport function should be used. Multiple-grain-size functions are very sensitive to the grain-size distribution of the bed material. Extreme care must be exercised in order to ensure that the fine component of the bed-material gradation is representative of the bed surface for the specified discharge. This is very difficult without measured data. For this reason Einstein (1950) recommended ignoring the finest 10 percent of the bed material sample for computation of bed-material load with a multiple-grain-size function. Frequently, single-grain-size functions are converted to multiple-grain-size functions simply by calculating sediment transport using geometric mean diameters for each size class in the bed (sediment transport potential) and then assuming that transport of that size class (sediment transport capacity) can be obtained by multiplying the sediment transport potential by the bed fraction. This can produce unreliable results since the assumption is that each size class fraction in the bed acts independent of other size classes on the bed, thus ignoring the effects of hiding.

## Description

SAM.aid is based on the premise that a sediment transport function that accurately predicts measured sediment in a gaged stream would be an appropriate predictor in an ungaged stream with similar characteristics. SAM.aid compares calculated "screening parameters" for a given river to the same screening parameters from a database of rivers (Brownlie, 1981) that have sufficient sediment data to determine an appropriate sediment transport function. The "screening parameters" are velocity, depth, slope, width, and  $d_{50}$ . It should be noted that Brownlie reduced measured bed material gradations to median grain sizes and geometric standard deviations. This means that this guidance is not applicable to rivers that have bed gradations that are not log-normally distributed.

When the user inputs velocity, depth, slope, width and  $d_{50}$  for an ungaged river, SAM.aid compares each of these screening parameters with those of each river in the Brownlie database. A "match" is identified when a parameter falls within the range of data for a database river. The  $d_{50}$  must fall within the range for a river in the database before SAM.aid will examine the other parameters. The three best sediment transport functions for each database river is then listed, along with the type of parameter(s) that matched and the name of the data set matched.

After the matches are displayed, the user can check the description of the rivers on which SAM.aid based its choices to see how close those descriptions match the user's river or stream. This is an essential step in ensuring that the sediment transport functions will actually provide the best predictive capability for the river in question. This will also narrow the choices when SAM.aid displays several data sets that "matched" a user's data, all with the same matching screening parameters.

## Criteria for selecting sediment transport functions

Discrepancy ratios were calculated for each measured discharge. Raphelt (1996) describes the discrepancy ratio that Yang (1984), van Rijn (1984) and others have used as

$$\frac{q_s \text{ computed}}{q_s \text{ measured}}$$

The percentage of measurements with discrepancy ratios between 0.5 and 2.0<sup>1</sup> was determined, and the average discrepancy ratio was calculated. The five to eight sediment transport functions with the highest percentage of discrepancy ratios within the selected range were selected first. From these, the functions were ranked by average discrepancy ratio. The function with the discrepancy ratio closest to 1.0 was ranked highest.

Only one of the Toffaleti function combinations was considered in each ranking. For instance, if both the Toffaleti and the Toffaleti-Schoklitsch functions ranked in the top three, only the function with the highest ranking would be included in the final recommendations. For some functions, sediment transport is calculated two ways: 1) assuming a median grain size and 2) making calculations by size class fractions. For these functions only the multiple grain size option was considered in the rankings. Since the Brownlie function calculates sediment transport using only using the median grain size, it is included in the rankings.

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<sup>1</sup> This range, 0.5 to 2.0 was chosen because it is the range that is used in many other researchers in this field. The original basis for SAM (1980), White, Milli and Crabbe (1978), among others. 65

In some cases, when the data is clearly outside the range for which a sediment transport function was developed, it is excluded from the rankings.

The rankings for all the sediment transport functions in SAM.sed, for all the data sets in SAM.aid, are given in tables 5.1 through 5.xyz. They are also available onscreen in SAM.aid as part of the site description, allowing the user to apply personal engineering judgement and experience. This is an important feature to remember since the results of SAM.aid are meant only as suggestions, for guidance.

**Table 5.1. LIST OF BROWNLIE DATA SETS**

<b>Data Code</b>	<b>River and Investigator(s)</b>
ACP	ACOP Canal, k. Mahmood et al., 1979
AMC	American Canal, D. B. Simons, 1957
ATC	Atchafalaya River, F. B. Toffaleti, 1968
CHO	Chop Canals, Chaudhry et al., 1970
COL	Colorado River, U. S. Bureau of Reclamation, 1958
HII	Hii River, K. Shinohara and T. Tsubaki, 1959
LEO	River Data, L. B. Leopold, 1969
MID	Middle Loup River, D. Hubbell and D. Matejka, 1959
MIS	Mississippi River, F. B. Toffaleti, 1968
MOU	Mountain Creek, H. A. Einstein, 1944
NED	Rio Magdalena and Canal del Dique, NEDCO, 1973
NIO	Niobrara River, B. R. Colby and C. H. Hembree, 1955
NSR	North Saskatchewan River and Elbow River, G. W. Samide, 191
OAK	Oak Creek, Oregon, R. T. Milhous. 1973
POR	Portugal Rivers, L. V. da Cunha, 1969
RED	Red River, F. B. Toffaleti, 1968
RGC	Rio Grande Conveyance Channel, J. K. Culbertson et al., 1976
RGR	Rio Grande River, C. F. Nordin and C. P. Beverage, 1965
RIO	Rio Grande near Bernalillo, NM, F. B. Toffaleti, 1968

**Table 5.2. Sediment Transport Function Rankings for ACP Data Set.**

DATA SET: ACP	# DATA POINTS	IN SET: 142		
FUNCTION	Percent of data points in discrepancy ratio	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio	
TOFFALETI-MPM		57.04	1.343	1.2863
TOFFALETI.	3	56.34	1.222	1.2112
TOFFALETI-SCHOKLITSCH		55.63	1.305	1.2650
LAURSEN(COPELAND)		54.93	1.567	1.7284
PROFITT(SUTHERLAND)		54.23	1.716	1.6165
LAURSEN(MADDEN),1985		53.52	1.440	1.7098
ACKERS-WHITE.	2	50.70	0.830	0.7461
ACKERS-WHITE, D50		49.30	0.859	0.7996
ENGELUND-HANSEN	1	45.77	1.019	0.9600
BROWNIE, D50		44.37	0.812	0.7816
VAN RIJN		41.55	0.731	0.8370
COLBY		40.14	1.456	1.6258
EINSTEIN(TOTAL-LOAD)		37.32	1.405	1.9642
YANG, D50		31.69	0.445	0.7005
YANG.		26.76	0.416	0.7059
EINSTEIN(BED-LOAD)		21.13	0.370	0.8619
MPM(1948),D50		5.63	0.158	0.8590
MPM(1948).		2.11	0.137	0.8759
SCHOKLITSCH		0.70	0.094	0.9140
PARKER		0.00	0.000	1.0035

**Table 5.3. Sediment Transport Function Rankings for AMC Data Set.**

DATA SET: AMC	# DATA POINTS	IN SET: 11		
FUNCTION	Percent of data points in discrepancy ratio	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio	
LAURSEN(COPELAND)	1	45.45	1.092	1.2213
PROFITT(SUTHERLAND)		45.45	0.462	0.6777
BROWNIE, D50		27.27	0.309	0.7708
LAURSEN(MADDEN),1985	3	27.27	0.690	0.8809
ENGELUND-HANSEN		27.27	0.434	0.6877
ACKERS-WHITE, D50		27.27	0.294	0.7822
COLBY		27.27	0.370	0.7592
ACKERS-WHITE.		27.27	0.283	0.7858
EINSTEIN(TOTAL-LOAD)	2	27.27	0.741	1.2944
TOFFALETI.		18.18	0.455	0.8375
YANG.		18.18	0.270	0.8012
EINSTEIN(BED-LOAD)		18.18	0.230	0.8374
VAN RIJN		18.18	0.359	0.7513
TOFFALETI-MPM		18.18	0.579	0.7908
TOFFALETI-SCHOKLITSCH		18.18	0.490	0.8215
YANG, D50		18.18	0.265	0.8115
MPM(1948),D50		9.09	0.175	0.8835

SCHOKLITSCH	0.00	0.041	1.0068
MPM(1948).	0.00	0.150	0.9008
PARKER	0.00	0.001	1.0473

**Table 5.4. Sediment Transport Function Rankings for ATC Data Set.**

DATA SET: ATC	# DATA POINTS	IN SET: 63	
FUNCTION	Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
COLBY	69.84	1.285	1.0056
LAURSEN(COPELAND)	3	1.140	1.2790
LAURSEN(MADDEN),1985	1	1.104	1.1584
TOFFALETI-MPM	65.08	1.169	1.3231
TOFFALETI.	2	1.132	1.3043
TOFFALETI-SCHOKLITSCH	63.49	1.142	1.3154
PROFITT(SUTHERLAND)	57.14	1.197	1.3708
VAN RIJN	42.86	0.621	0.7357
BROWNIE, D50	39.68	0.533	0.5941
ACKERS-WHITE.	36.51	0.657	0.8902
ENGELUND-HANSEN	34.92	0.498	0.6517
ACKERS-WHITE, D50	33.33	0.521	0.6789
EINSTEIN(TOTAL-LOAD)	20.63	4.208	5.8703
EINSTEIN(BED-LOAD)	7.94	0.182	0.8557
YANG.	3.17	0.132	0.8832
YANG, D50	1.59	0.137	0.8784
SCHOKLITSCH	0.00	0.012	0.9959
MPM(1948).	0.00	0.056	0.9522
MPM(1948),D50	0.00	0.070	0.9389
PARKER	0.00	0.000	1.0080

**Table 5.5. Sediment Transport Function Rankings for CHO Data Set.**

DATA SET: CHO	# DATA POINTS	IN SET: 33	
FUNCTION	Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
COLBY	1	0.826	0.5573
PROFITT(SUTHERLAND)	54.55	2.743	5.2183
ACKERS-WHITE, D50	51.52	1.201	1.9122
ENGELUND-HANSEN	3	0.753	0.7301
BROWNIE, D50	45.45	0.635	0.6155
LAURSEN(COPELAND)	42.42	2.347	5.6214
ACKERS-WHITE.	2	1.211	1.9239
VAN RIJN	33.33	0.986	1.3950
TOFFALETI-MPM	27.27	1.603	2.8109
TOFFALETI-SCHOKLITSCH	27.27	1.604	2.8167
EINSTEIN(TOTAL-LOAD)	21.21	2.372	6.9618
YANG, D50	18.18	0.467	0.7810
YANG.	18.18	0.422	0.7588
LAURSEN(MADDEN),1985	18.18	1.897	3.9564
TOFFALETI.	15.15	1.541	2.7744
SCHOKLITSCH	0.00	0.079	0.9387
MPM(1948).	0.00	0.075	0.9404

MPM(1948),D50	0.00	0.085	0.9308
PARKER	0.00	0.000	1.0155
EINSTEIN(BED-LOAD)	0.00	0.113	0.9050

Table 5.6. Sediment Transport Function Rankings for COL Data Set.

DATA SET: COL	# DATA POINTS	IN SET: 100	
FUNCTION	Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
PROFIT(SUTHERLAND)	72.00	1.249	1.4127
COLBY	2	1.144	1.5363
ENGELUND-HANSEN	1	1.004	0.8986
LAURSEN(COPELAND)	3	0.851	1.1833
ACKERS-WHITE, D50	49.00	0.700	0.8543
BROWNLIE, D50	48.00	0.704	0.8256
ACKERS-WHITE.	44.00	0.672	0.8588
TOFFALETI-MPM	39.00	0.624	0.7591
TOFFALETI-SCHOKLITSCH	39.00	0.614	0.7486
YANG.	38.00	0.472	0.6868
YANG, D50	38.00	0.503	0.6802
LAURSEN(MADDEN),1985	32.00	0.595	0.7617
VAN RIJN	31.00	0.518	0.9252
TOFFALETI.	29.00	0.502	0.7606
EINSTEIN(TOTAL-LOAD)	27.00	0.587	0.8892
EINSTEIN(BED-LOAD)	14.00	0.298	0.7617
SCHOKLITSCH	2.00	0.123	0.8885
MPM(1948).	2.00	0.136	0.8771
MPM(1948),D50	2.00	0.159	0.8575
PARKER	0.00	0.000	1.0050

Table 5.7. Sediment Transport Function Rankings for HII Data Set.

DATA SET: HII	# DATA POINTS	IN SET: 38	
FUNCTION	Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
YANG.	94.74	1.290	0.5404
EINSTEIN(BED-LOAD)	2	1.219	0.6851
ENGELUND-HANSEN	84.21	1.246	0.6062
PROFIT(SUTHERLAND)	3	1.225	0.6691
TOFFALETI-MPM	1	0.815	0.4836
EINSTEIN(TOTAL-LOAD)	73.68	1.586	1.0890
ACKERS-WHITE,D50	68.42	0.667	0.4901
ACKERS-WHITE.	68.42	0.623	0.4999
VAN.RIJN	65.79	0.898	0.7972
YANG,D50	63.16	1.806	1.0598
BROWNLIE,D50	52.63	0.513	0.5586
MPM(1948),D50	52.63	0.661	0.5770
MPM(1948).	50.00	0.535	0.6076
LAURSEN(COPELAND)	44.74	2.500	2.1361
TOFFALETI-SCHOKLITSC	42.11	1.512	1.4665
COLBY	42.11	0.571	0.8030
SCHOKLITSCH	42.11	1.230	1.2945
TOFFALETI.	28.95	0.338	0.7500
LAURSEN(MADDEN),1985	26.32	0.370	0.7345

PARKER	13.16	0.258	0.8996
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**Table 5.8. Sediment Transport Function Rankings for LEO Data Set.**

DATA SET: LEO	# DATA POINTS	IN SET: 55	
FUNCTION	Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
COLBY	3	61.82	1.351
PROFIT(SUTHERLAND)		56.36	2.245
BROWNIE,D50	2	56.36	0.907
ACKERS-WHITE,D50	1	49.09	1.013
YANG,D50		47.27	0.699
YANG.		47.27	0.674
ENGELUND-HANSEN		45.45	1.393
ACKERS-WHITE.		45.45	1.274
LAURSEN(COPELAND)		38.18	1.290
TOFFALETI-MPM		38.18	1.016
TOFFALETI-SCHOKLITSCH		36.36	1.024
VAN.RIJN		36.36	0.806
EINSTEIN(TOTAL-LOAD)		34.55	0.847
TOFFALETI.		32.73	0.876
LAURSEN(MADDEN),1985		29.09	1.496
EINSTEIN(BED-LOAD)		14.55	0.303
SCHOKLITSCH		5.45	0.167
MPM(1948),D50		3.64	0.179
MPM(1948).		1.82	0.155
PARKER		0.00	0.000
			1.0092

**Table 5.9. Sediment Transport Function Rankings for MID Data Set.**

DATA SET: MID	# DATA POINTS	IN SET: 38	
FUNCTION	Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
ENGELUND-HANSEN	1	89.47	0.947
TOFFALETI-SCHOKLITSCH	2	89.47	0.908
COLBY		86.84	0.839
PROFIT(SUTHERLAND)		86.84	1.349
YANG.	3	84.21	0.866
YANG, D50		84.21	0.850
ACKERS-WHITE, D50		81.58	0.792
ACKERS-WHITE.		81.58	0.788
VAN RIJN		81.58	0.862
LAURSEN(MADDEN),1985		71.05	0.785
TOFFALETI-MPM		71.05	0.710
EINSTEIN(TOTAL-LOAD)		65.79	0.964
BROWNIE, D50		60.53	0.613
LAURSEN(COPELAND)		44.74	2.528
SCHOKLITSCH		36.84	0.448
TOFFALETI.		34.21	0.487
EINSTEIN(BED-LOAD)		18.42	0.381
			0.6417

MPM(1948),D50	2.63	0.286	0.7324
PARKER	0.00	0.001	1.0120
MPM(1948).	0.00	0.235	0.7798

**Table 5.10. Sediment Transport Function Rankings for MIS Data Set.**

DATA SET: MIS	# DATA POINTS	IN SET: 164		
FUNCTION	Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio	
COLBY	76.22	1.547	1.0581	
BROWNIE, D50	3	0.830	0.4689	
PROFIT(SUTHERLAND)		1.491	1.4003	
ACKERS-WHITE, D50		0.720	0.5006	
ENGELUND-HANSEN	2	1.081	0.7669	
LAURSEN(COPELAND)	1	1.048	1.0764	
ACKERS-WHITE.		1.093	1.2248	
VAN RIJN		0.848	0.6916	
TOFFALETI-MPM		0.976	0.9019	
TOFFALETI-SCHOKLITSCH		0.927	0.8960	
TOFFALETI.		0.882	0.8655	
LAURSEN(MADDEN),1985		1.393	2.5404	
YANG.	39.02	0.457	0.6310	
YANG, D50		0.453	0.6288	
EINSTEIN(TOTAL-LOAD)		3.611	6.4857	
EINSTEIN(BED-LOAD)		0.179	0.8375	
MPM(1948),D50		0.147	0.8618	
SCHOKLITSCH		0.052	0.9525	
MPM(1948).		0.119	0.8871	
PARKER		0.004	0.9990	

**Table 5.11. Sediment Transport Function Rankings for MOU Data Set.**

DATA SET: MOU	# DATA POINTS	IN SET: 100		
FUNCTION	Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio	
MPM(1948).	1	89.00	1.055	0.4512
MPM(1948),D50		86.00	1.151	0.5324
BROWNIE, D50	2	85.00	1.159	0.8983
ACKERS-WHITE.	3	80.00	1.510	1.4543
ACKERS-WHITE, D50		76.00	1.668	1.5602
TOFFALETI-MPM		72.00	1.630	1.3082
ENGELUND-HANSEN		71.00	1.938	1.5777
YANG.		68.00	2.015	1.6222
EINSTEIN(BED-LOAD)		67.00	1.764	1.2732
TOFFALETI-SCHOKLITSCH		62.00	1.463	1.4282
COLBY		61.00	1.859	1.7847
EINSTEIN(TOTAL-LOAD)		61.00	2.314	2.3943
YANG, D50		60.00	2.241	1.8333
TOFFALETI.		42.00	0.801	1.0200
VAN RIJN		39.00	2.896	2.7415

PROFIT(SUTHERLAND)	33.00	3.124	3.1845
SCHOKLITSCH	33.00	0.740	0.8733
LAURSEN(MADDEN),1985	17.00	0.587	0.8257
LAURSEN(COPELAND)	9.00	6.768	8.6024
PARKER	7.00	0.109	0.9213

**Table 5.12. Sediment Transport Function Rankings for NED Data Set.**

DATA SET: NED	# DATA POINTS	IN SET: 66		
FUNCTION		Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
VAN RIJN	2	53.03	0.940	0.9852
BROWNIE, D50		53.03	0.650	0.5866
COLBY		50.00	1.933	10.0131
PROFIT(SUTHERLAND)		50.00	1.103	1.3030
ENGELUND-HANSEN	1	48.48	1.000	0.8293
YANG, D50		42.42	0.596	0.7126
TOFFALETI-SCHOKLITSCH	3	42.42	1.090	1.3328
TOFFALETI-MPM		40.91	1.123	1.3662
ACKERS-WHITE.		40.91	0.761	0.8038
TOFFALETI.		37.88	1.016	1.3059
YANG.		37.88	0.507	0.6720
ACKERS-WHITE, D50		31.82	0.588	0.7186
LAURSEN(MADDEN),1985		31.82	1.163	1.4970
LAURSEN(COPELAND)		30.30	1.687	2.2986
EINSTEIN(TOTAL-LOAD)		13.64	1.587	3.6978
EINSTEIN(BED-LOAD)		9.09	0.201	0.8536
MPM(1948),D50		6.06	0.180	0.8585
MPM(1948).		3.03	0.137	0.8842
SCHOKLITSCH		1.52	0.098	0.9163
PARKER		0.00	0.029	0.9827

**Table 5.13. Sediment Transport Function Rankings for NIO Data Set.**

DATA SET: NIO	# DATA POINTS	IN SET: 40		
FUNCTION		Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
BROWNIE, D50		97.50	0.804	0.3088
TOFFALETI-SCHOKLITSCH		97.50	1.166	0.4614
YANG, D50		97.50	1.158	0.3790
ACKERS-WHITE, D50		97.50	1.060	0.4113
YANG.	2	97.50	1.170	0.3763
TOFFALETI-MPM	1	92.50	0.954	0.4436
ENGELUND-HANSEN		92.50	1.378	0.5148
COLBY	3	92.50	0.832	0.3227
ACKERS-WHITE.		87.50	1.242	0.6482
VAN RIJN		85.00	1.223	0.7311
TOFFALETI.		72.50	0.774	0.4962
LAURSEN(MADDEN),1985		70.00	1.328	0.8450
EINSTEIN(TOTAL-LOAD)		67.50	1.188	0.8245
PROFIT(SUTHERLAND)		60.00	1.953	1.2746
LAURSEN(COPELAND)		47.50	2.624	2.2278

SCHOKLITSCH	30.00	0.490	0.5416
EINSTEIN(BED-LOAD)	7.50	0.298	0.7168
MPM(1948),D50	0.00	0.215	0.7974
PARKER	0.00	0.000	1.0127
MPM(1948).	0.00	0.186	0.8264

**Table 5.14. Sediment Transport Function Rankings for NSR Data Set.**

DATA SET: NSR	# DATA POINTS	IN SET: 55	
FUNCTION	Percent of data points in discrepancy ratio range	Average Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
LAURSEN(MADDEN),1985	1	58.18	1.475
SCHOKLITSCH	3	56.36	2.317
TOFFALETI-SCHOKLITSCH		56.36	2.384
BROWNIE, D50	2	50.91	1.703
VAN RIJN		47.27	0.950
ACKERS-WHITE.		43.64	3.268
ACKERS-WHITE, D50		34.55	3.806
PARKER		27.27	6.603
PROFITT(SUTHERLAND)		21.82	6.493
YANG.		21.82	6.255
YANG, D50		20.00	9.118
MPM(1948),D50		14.55	6.661
MPM(1948).		9.09	7.636
TOFFALETI-MPM		9.09	7.712
TOFFALETI.		7.27	0.161
EINSTEIN(BED-LOAD)		1.82	13.757
EINSTEIN(TOTAL-LOAD)		1.82	13.762
LAURSEN(COPELAND)		1.82	20.655
COLBY		0.00	0.000
ENGELUND-HANSEN		0.00	21.050
			28.2610

**Table 5.15. Sediment Transport Function Rankings for OAK Data Set.**

DATA SET: OAK	# DATA POINTS	IN SET: 17	
FUNCTION	Percent of data points in discrepancy ratio range	Average Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
LAURSEN(MADDEN),1985	1	41.18	1.081
ACKERS-WHITE.		29.41	0.373
TOFFALETI.		29.41	0.850
YANG.	2	29.41	1.142
BROWNIE, D50	3	17.65	0.862
MPM(1948),D50		5.88	2.651
PROFITT(SUTHERLAND)		5.88	0.136
PARKER		0.00	185.278
VAN RIJN		0.00	181.225
SCHOKLITSCH		0.00	56.861
ENGELUND-HANSEN		0.00	89.682
EINSTEIN(BED-LOAD)		0.00	25.277
ACKERS-WHITE, D50		0.00	0.000
TOFFALETI-SCHOKLITSCH		0.00	57.585
COLBY		0.00	0.000
EINSTEIN(TOTAL-LOAD)		0.00	25.301
			33.3628

MPM(1948).	0.00	27.752	40.5980
YANG, D50	0.00	0.019	1.0141
LAURSEN(COPELAND)	0.00	108.222	160.7211
TOFFALETI-MPM	0.00	28.486	41.5653

**Table 5.16. Sediment Transport Function Rankings for POR Data Set.**

DATA SET: POR	# DATA POINTS	IN SET: 219	
FUNCTION	Percent of data points in discrepancy ratio range	Average Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
YANG.	1	87.21	1.009
LAURSEN(COPELAND)	2	67.58	1.245
ENGELUND-HANSEN	3	65.75	1.933
BROWNIE, D50		48.86	0.563
PROFITT(SUTHERLAND)		44.75	0.613
EINSTEIN(TOTAL-LOAD)		43.38	0.734
MPM(1948),D50		42.92	0.538
EINSTEIN(BED-LOAD)		42.92	0.722
PARKER		41.10	1.803
TOFFALETI-MPM		35.62	0.542
MPM(1948).		31.51	0.485
ACKERS-WHITE.		23.74	0.387
VAN RIJN		19.63	0.386
TOFFALETI-SCHOKLITSCH		17.81	0.378
ACKERS-WHITE, D50		12.33	0.279
SCHOKLITSCH		10.96	0.313
YANG, D50		2.28	0.103
COLBY		0.46	0.131
TOFFALETI.		0.00	0.086
LAURSEN(MADDEN),1985		0.00	0.117
			0.8882

**Table 5.17. Sediment Transport Function Rankings for RED Data Set.**

DATA SET: RED	# DATA POINTS	IN SET: 30	
FUNCTION	Percent of data points in discrepancy ratio range	Average Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
TOFFALETI-MPM		93.33	0.968
TOFFALETI-SCHOKLITSCH	1	90.00	1.010
ACKERS-WHITE.	3	86.67	1.047
LAURSEN(COPELAND)	2	83.33	0.960
TOFFALETI.		83.33	0.895
ENGELUND-HANSEN		66.67	1.239
PROFITT(SUTHERLAND)		63.33	2.167
LAURSEN(MADDEN),1985		60.00	2.348
ACKERS-WHITE, D50		50.00	0.874
EINSTEIN(TOTAL-LOAD)		30.00	2.176
BROWNIE, D50		26.67	0.462
VAN RIJN		23.33	0.352
COLBY		16.67	0.353
YANG, D50		13.33	0.369
EINSTEIN(BED-LOAD)		10.00	0.177
			0.8616

YANG.	10.00	0.339	0.7302
SCHOKLITSCH	3.33	0.116	0.9108
MPM(1948).	0.00	0.073	0.9442
MPM(1948),D50	0.00	0.091	0.9269
PARKER	0.00	0.000	1.0171

**Table 5.18. Sediment Transport Function Rankings for RGC Data Set.**

DATA SET: RGC	# DATA POINTS	IN SET: 8	
FUNCTION	Percent of data points in discrepancy ratio range	Average Standard deviation of Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
TOFFALETI-MPM	87.50	0.932	0.6064
TOFFALETI-SCHOKLITSCH	1	0.983	0.5786
LAURSEN(MADDEN),1985	3	0.910	0.4430
ENGELUND-HANSEN	2	0.955	0.3160
YANG, D50	87.50	0.656	0.4267
YANG.	75.00	0.612	0.4568
LAURSEN(COPELAND)	75.00	1.407	1.2483
ACKERS-WHITE, D50	75.00	0.814	0.4445
VAN RIJN	75.00	0.834	0.5599
PROFIT(SUTHERLAND)	75.00	1.578	1.1581
BROWNIE, D50	75.00	0.603	0.4792
COLBY	75.00	0.626	0.4480
ACKERS-WHITE.	75.00	0.912	0.6165
TOFFALETI.	62.50	0.862	0.6174
EINSTEIN(TOTAL-LOAD)	50.00	0.813	0.6449
SCHOKLITSCH	0.00	0.165	0.8947
MPM(1948).	0.00	0.072	0.9923
MPM(1948),D50	0.00	0.082	0.9821
PARKER	0.00	0.000	1.0690
EINSTEIN(BED-LOAD)	0.00	0.112	0.9505

**Table 5.19. Sediment Transport Function Rankings for RGR Data Set.**

DATA SET: RGR	# DATA POINTS	IN SET: 286	
FUNCTION	Percent of data points in discrepancy ratio range	Average Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
PROFIT(SUTHERLAND)	59.79	1.448	1.9547
ENGELUND-HANSEN	58.39	2.175	7.4489
LAURSEN(COPELAND)	53.50	2.370	3.7390
YANG, D50	52.80	1.202	2.7583
TOFFALETI-SCHOKLITSCH	50.00	1.442	4.3807
YANG.	48.95	1.208	2.5535
ACKERS-WHITE.	44.06	1.279	2.7020
ACKERS-WHITE, D50	43.36	0.703	0.8658
VAN RIJN	42.66	0.929	1.3087
BROWNIE, D50	40.56	0.675	0.8832
TOFFALETI-MPM	40.21	0.729	0.8448
EINSTEIN(TOTAL-LOAD)	38.81	1.041	1.5765
LAURSEN(MADDEN),1985	34.27	1.065	1.5503
COLBY	31.12	1.217	11.2550

TOFFALETI.	29.02	0.511	0.7592
SCHOKLITSCH	19.58	0.992	4.2301
EINSTEIN(BED-LOAD)	12.94	0.349	0.8443
MPM(1948),D50	9.79	0.274	0.8270
MPM(1948).	8.04	0.230	0.8460
PARKER	0.70	0.018	0.9877

**Table 5.20. Sediment Transport Function Rankings for RIO Data Set.**

DATA SET: RIO	# DATA POINTS	IN SET: 38	
FUNCTION	Percent of data points in discrepancy ratio range	Average Discrepancy Ratio	Standard Deviation of Discrepancy Ratio
PROFIT(SUTHERLAND)	97.37	1.343	0.5688
ACKERS-WHITE.	2	0.861	0.3329
ACKERS-WHITE, D50	94.74	0.818	0.3245
VAN RIJN	1	1.013	0.4775
BROWNLIE, D50	86.84	0.729	0.3848
COLBY	3	0.731	0.4029
ENGELUND-HANSEN	65.79	0.706	0.4176
YANG.	63.16	0.567	0.4759
YANG, D50	63.16	0.579	0.4672
EINSTEIN(TOTAL-LOAD)	63.16	1.309	0.8508
TOFFALETI-SCHOKLITSCH	63.16	0.633	0.4708
TOFFALETI-MPM	63.16	0.622	0.4756
LAURSEN(COPELAND)	57.89	1.962	1.3509
TOFFALETI.	42.11	0.541	0.5399
LAURSEN(MADDEN),1985	39.47	0.508	0.5844
EINSTEIN(BED-LOAD)	2.63	0.177	0.8408
MPM(1948).	0.00	0.123	0.8904
SCHOKLITSCH	0.00	0.137	0.8794
PARKER	0.00	0.000	1.0134
MPM(1948),D50	0.00	0.140	0.8735

## Data Ranges of the Data Sets used in SAM.aid

The data sets used in SAM.aid for comparison of user-input data each have a range of values for the five selection parameters:  $d_{50}$ , velocity, depth, width, and slope. These ranges are given in tables 5.xyz through 5.yza. However, in the SAM.aid program the upper and lower limits of the ranges for  $D_{50}$  have been extended to the next size class boundary, according to the American Geophysical Union standard size classes. This allows a somewhat wider range of choices to be offered to the user without compromising the theory behind SAM.aid.

**Table 5.22. Data ranges of the data sets referenced in SAM.aid.**

ACP			AMC		
D50	0.0830	0.3640	D50	0.0960	7.0000
SLOPE	0.0004510	0.0001358	SLOPE	0.0000580	0.0003300
VELOCITY	1.1445	4.2513	VELOCITY	1.3630	2.5167
WIDTH	112.9703	459.8822	WIDTH	10.4973	72.7812
DEPTH	2.4994	14.0965	DEPTH	2.6092	8.4978
ATC			CHO		
D50	0.0800	0.3033	D50	0.0900	0.3200
SLOPE	0.0000056	0.0000513	SLOPE	0.0000510	0.0002538
VELOCITY	1.0000	6.6000	VELOCITY	2.2000	5.3000
WIDTH	1000.0	1650.0	WIDTH	75.0000	400.0000
DEPTH	20.0000	50.0000	DEPTH	4.2000	12.0000
COL			HII		
D50	0.1550	0.6950	D50	0.210	1.440
SLOPE	0.0000370	0.0004070	SLOPE	0.0008400	0.0113000
VELOCITY	1.5561	4.1576	VELOCITY	0.47	3.05
WIDTH	303.8716	834.9249	WIDTH	1.14	26.25
DEPTH	3.7192	12.7566	DEPTH	0.06	2.4
LEO			MID		

D50	0.140	0.814	D50	0.2000	0.4500
SLOPE	0.0000533	0.0003460	SLOPE	0.0009000	.0016000
VELOCITY	1.19	4.14	VELOCITY	1.9000	3.7000
WIDTH	291.01	822.03	WIDTH	122.0000	153.0000
DEPTH	3.15	13.47	DEPTH	0.8000	1.4000
MIS			MOU		
D50	0.1629	1.1292	D50	0.2859	0.8992
SLOPE	0.0000183	0.0001336	SLOPE	.0013600	.0031500
VELOCITY	2.0000	8.0000	VELOCITY	1.2008	4.4326
WIDTH	1495.0000	3640.0000	WIDTH	10.7971	14.2165
DEPTH	15.0000	60.0000	DEPTH	0.1299	1.4366
NED			NIO		
D50	0.1000	1.0800	D50	0.2000	0.3600
SLOPE	0.0000030	0.0006200	SLOPE	.0011000	.0018000
VELOCITY	0.6507	5.3835	VELOCITY	2.0000	4.2000
WIDTH	88.5600	2771.5990	WIDTH	65.0000	75.0000
DEPTH	4.3296	43.5584	DEPTH	1.3000	2.0000
NSR			OAK		
D50	13.0000	76.0000	D50	8.2000	27.0000
SLOPE	.0015800	.0074500	SLOPE	.0097000	.0126000
VELOCITY	5.0000	11.0000	VELOCITY	2.6502	3.6719
WIDTH	9.0000	20.0000	WIDTH	13.8577	19.3976
DEPTH	2.0000	9.0000	DEPTH	1.0076	1.7256
POR			RED		
D50	2.2000	2.6000	D50	0.0900	0.2200
SLOPE	.0005400	.0009700	SLOPE	0.0000661	0.0000824
VELOCITY	2.0000	4.8000	VELOCITY	1.2000	3.8000
WIDTH	225.0000	620.0000	WIDTH	425.0000	600.0000
DEPTH	1.5000	8.0000	DEPTH	9.8000	25.0000

RGC	RGR
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D50	0.1800	0.2800	D50	0.1700	5.2000
SLOPE	0.0005300	0.0008000	SLOPE	0.0006900	.0024600
VELOCITY	2.6000	5.0000	VELOCITY	0.6000	8.0000
WIDTH	65.0000	75.0000	WIDTH	25.0000	400.0000
DEPTH	3.0000	5.0000	DEPTH	.5000	11.0000
RIO					
D50	0.2073	0.3676			
SLOPE	0.0007400	0.0008900			
VELOCITY	2.0481	7.8271			
WIDTH	132.9659	644.8348			
DEPTH	1.0896	4.7986			